Claims:

1. A production method of an oxynitride powder, characterized in that the method comprises the step of:

applying a heat treatment in a reducing and nitriding atmosphere, to a precursor compound including at least constituent elements M, Si, Al, and O (where M is one element or mixed two or more elements selected from Li, Mg, Ca, Sr, Y, La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, and Lu), thereby decreasing an oxygen content and increasing a nitrogen content of the precursor.

2. The production method of an oxynitride powder of claim 1, characterized in that the precursor compound includes nitrogen (N) therein.

3. The production method of an oxynitride powder of claim 1 or 2, characterized in that the method further comprises the step of:

applying a heat treatment in a reducing and nitriding atmosphere, to the precursor compound, thereby decreasing an oxygen content and increasing a nitrogen content of the precursor, to produce an α-sialon represented by a general formula

$M_xSi_{12-(m+n)}Al_{m+n}O_nN_{16-n}$ ($0<x\leq 2$, $0<m\leq 6$, and $0\leq n\leq 3$).

4. The production method of an oxynitride powder of any one of claims 1 through 3, characterized in that the precursor compound is a mixture of: a compound (compound SiX) which turns into silicon dioxide, silicon oxynitride, or silicon nitride, by heating; a compound (compound MX)

which turns into oxide, oxynitride, or nitride of M by heating; and a compound (compound AlX) which turns into aluminum oxide, aluminum oxynitride, or aluminum nitride, by heating.

5. The production method of an oxynitride powder of claim 4, characterized in that the SiX is one compound or mixed two or more compounds selected from silicon dioxide (SiO_2), silicon oxynitride (Si_2N_2O), and silicon nitride (Si_3N_4).

6. The production method of an oxynitride powder of any one of claims 4 through 5, characterized in that the MX is one compound or mixed two or more compounds selected from oxide, hydroxide, alkoxide, carbonate, nitrate, and chloride, of M.

7. The production method of an oxynitride powder of any one of claims 4 through 6, characterized in that the AlX is one compound or mixed two or more compounds selected from oxide, hydroxide, alkoxide, carbonate, nitrate, and chloride, of aluminum.

8. The production method of an oxynitride powder of any one of claims 4 through 7, characterized in that MX particles and AlX particles have averaged particle sizes smaller than that of SiX particles, respectively.

9. The production method of an oxynitride powder of any one of claims 4 through 7, characterized in that the SiX has an averaged particle size of 2μm or less.

10. The production method of an oxynitride powder of

any one of claims 4 through 9, characterized in that the MX and AlX are attached to a surface of the SiX.

11. The production method of an oxynitride powder of any one of claims 4 through 10, characterized in that the precursor compound is a mixture obtained by dispersing SiX particles in a solution including the MX and AlX dissolved therein followed by drying and desolvation, the mixture being in a form where compounds of the M and Al are attached to a surface of a SiX particle.

12. The production method of an oxynitride powder of any one of claims 4 through 11, characterized in that the precursor compound is a complex citrate obtained by dispersing the SiX in an aqueous solution including the MX and AlX dissolved therein, followed by addition of citric acid and by drying and dehydration.

13. The production method of an oxynitride powder of any one of claims 4 through 12, characterized in that the precursor compound is a compound obtained by applying a heat treatment to a complex citrate to thereby decompose and eliminate citric acid therefrom, the complex citrate being obtained by dispersing the SiX in an aqueous solution including the MX and AlX dissolved therein, followed by addition of citric acid and by drying and dehydration.

14. The production method of an oxynitride powder of any one of claims 1 through 13, characterized in that the reducing and nitriding atmosphere includes at least an ammonia gas.

15. The production method of an oxynitride powder of any one of claims 1 through 14, characterized in that the reducing and nitriding atmosphere is a mixed gas atmosphere of ammonia and hydrocarbon gas.

16. The production method of an oxynitride powder of claim 15, characterized in that the hydrocarbon gas is a methane or propane gas.

17. The production method of an oxynitride powder of any one of claims 1 through 16, characterized in that the M includes at least Ca.

18. The production method of an oxynitride powder of any one of claims 1 through 17, characterized in that the M includes at least Eu.

19. The production method of an oxynitride powder of any one of claims 1 through 18, characterized in that the method further comprises the step of:

adding, into the precursor compound, one reaction accelerator or mixed two or more reaction accelerators selected from fluoride, chloride, sulfate, phosphate, and borate of an element selected from calcium, potassium, and aluminum, followed by a heat treatment in a reducing and nitriding atmosphere, thereby decreasing an oxygen content and increasing a nitrogen content of the precursor, to produce an α-sialon represented by a general formula

$M_xSi_{12-(m+n)}Al_{m+n}O_nN_{16-n}$ ($0<x\leq 2$, $0<m\leq 6$, and $0\leq n\leq 3$).

20. An oxynitride powder characterized in that the oxynitride powder is an α-sialon powder produced by the

method of any one of claims 1 through 19, and

that the α-sialon powder is represented by $Ca_{x1}Eu_{x2}Si_{12-(m+n)}Al_{m+n}O_nN_{16-n}$ while fully satisfying conditions of:

$0.4 \leq x_1 \leq 1.5$,

$0.01 \leq x_2 \leq 0.4$,

$0.8 \leq m \leq 3$, and

$0 \leq n \leq 2$.